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Research on this AASERT grant was focussed on the optical spectroscopy of trapped cold hydrogen for use as a spectroscopic tool and as a means of studying the gas. The grant supported research by two graduate students. During the grant an optical signal on the 1S – 2S transition in cold trapped hydrogen was observed, opening the way to a new form of ultra high resolution spectroscopy. The optical signal will also provide a valuable tool for manipulating a Bose condensate in hydrogen. The condensate can absorb two photons form a single running wave. The recoil is enough to sweep the atoms out of the trap, creating a new type of atom laser beam.

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November 7, 1997

Dr. Ralph Kelley
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Re: AASERT Grant F49620-93-1-0395, Final report

Dear Dr. Kelley,

This is the final report for the above AASERT grant.

The research under this grant is focussed on the optical spectroscopy of trapped cold hydrogen for use as a spectroscopic tool and as a means of studying the gas. The grant supported research by two outstanding graduate students, Dale Fried and Tom Killian. Both of these will prepare their theses in the near future.

During the period of this grant we succeeded in observing an optical signal on the 1S - 2S transition in cold trapped hydrogen, opening the way to a new form of ultra high resolution spectroscopy. The optical signal will also provide a valuable tool for manipulating a Bose condensate in hydrogen.. The condensate can absorb two photons from a single running wave. The recoil is enough to sweep the atoms out of the trap, creating a new type of atom laser beam.

The final stages of this research involved a major redesign of our trapping cell, allowing us to implement rf cooling of the trapped hydrogen. The new trap is currently being brought into production.

A list of publications supported by this work is attached.

Yours sincerely,

Dan Kleppner

Daniel Kleppner
Lester Wolfe Professor of Physics

Doppler-Free Spectroscopy of Trapped Atomic Hydrogen, Thomas C. Killian, Dale G. Fried, Claudio L. Cesar, Adam D. Polcyn, Thomas J. Greytak and Daniel Kleppner, Atomic Physics 15, H.B. Van Linden Van Den Heuvell, J.T.M Walraven, M.W. Reynolds (World Scientific, Singapore, 1997), p. 158. ICAP 96.

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